

JUL 17 1984

Confidential Claim Retracted

Authorized by: SC

Date: 6/24/13

Memorandum

To: Chief, Branch of Solid Minerals

From: Geologist

Subject: Possible Problems Associated with the Report Entitled "Evaluation of Hydrologic Effects Resulting from Pit Backfilling Jackpile-Paguata Uranium Mine, New Mexico" by Dames and Moore, March 23, 1983

1. Lack of any consideration for long-term major hydrologic cycles as illustrated on plate 10 of Dames and Moores report.

The implication of the cyclic weather pattern is that during the wetter portions of the cycle the water table would rise, and it is very probable that annual rainfall will be higher in the San Juan Basin in 50 to 100 years than it is now.

Figure 2.16, Momeni, et al, shows the departure from normal precipitation at Laguna for the period 1926-1980. The figure indicates a wetter 20 to 25 year period followed by a drier 25 to 30 year period. According to Dick Wilson, in the period before the Jackpile was mined, dry farming was done in the area. These wet and dry cycles appear to be part of longer-term major hydrologic cycles according to Euler, et al.

Euler identifies major hydrologic cycles occurring approximately every 550 years in the San Juan Basin and indicates that at present we are in the dry part of the cycle. His cycle identification is based on tree ring studies and pollen studies (the ratio of Juniper and Pinon to Ponderosa pollen). Results of both studies correlate well and are further substantiated by indications of diet changes of inhabitants and incursion of "exotic" species (i.e., marmot, bison and scaled quail) during wetter periods. Euler's article indicates the climate in the San Juan Basin is wetter than at present during most of the hydrologic cycle, and that the cycle is complex consisting of cycles (50 to 100 years) within cycles (275 years).

Euler states, "In combination, these inferred seasonal patterns of weather variation suggest that annual precipitation was substantially higher in AD 950 to 1150 than it is now. This conclusion is compatible with the geological evidence for generally higher hydrologic competence and higher water tables during the same period." (However, no geologic evidence is cited.)



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2. Failure to address the possibility that in the alkalic conditions at the Jackpile-Paguate, evaporate or protocalcrete deposits could form if insufficient backfill is used.

Jones presented an argument for upward diffusion of uranium due to capillary rise as a mechanism for uranium mineralization of calcrete. He envisioned cyclic rainfall changes causing pronounced changes in groundwater level and variations of CO₂ levels in the soil. Precipitation of uranium occurs as a result of the drop of the CO₂ level. If Jones' model is considered relevant to both evaporitic and protocalcrete deposition, we should note how closely conditions in the San Juan Basin compare to areas favorable for the development of calcrete.

Carlisle made observations on climate parameters for current uranium calcrete deposition. The Jackpile-Paguate area fully satisfies three parameters, as annual precipitation is under 10 inches and episodic rainfall occurs predominantly in summer and autumn storms. According to Murdock, there is a high annual evapotranspiration of about 24 inches and annual pan evaporation of about 70 inches in the Jackpile-Paguate area. This is considerably below the evapotranspiration rate (140 to 160 inches) found in actively developing calcrete areas. The annual evaporation ratio in the Jackpile-Paguate area (Ea/Pa) is about 8.7/1 (after Figure 2.17 Momeni, et al), compared to 15/1 or greater in the developing calcrete areas. Murdock's letter also implies a large soil moisture deficit, although it would not be as great as that given in the calcrete model.

I feel that the most outstanding reason there are no calcrete deposits in the San Juan Basin is that the climate in the Basin is usually wetter than it is now. Presently, we appear to be in a dry part of a major hydrologic cycle, the rest of the cycle being damp enough to remove any protocalcrete uranium deposit. However, this could be a mechanism for near-surface uranium concentration during the extended drought portion of the major known hydrologic cycle.

3. Failure to address the possibility of evaporite uranium deposits occurring due to the lack of drainage from the backfilled pits as modeled in the Dames and Moore study.

The same mechanism that could produce protocalcrete uranium deposits could also produce evaporites in an area with no drainage. These deposits would appear in the dry part of the hydrologic cycle and probably be reabsorbed during the wet part of the cycle.

4. Dames and Moore, on page 14 of their report, estimated backfill at 45 percent porosity.

The estimate was based on recompacted laboratory samples. The porosity appears to be a recalculation from specific gravity and dry density from

some laboratory permeability tests (Table A-18); however, this is not stated in the report.

The porosity results of Dames' and Moore's calculations are abnormally high as the backfill material consists chiefly of Mancos Shale with some sand and silt. This proposed backfill material is presently in waste dumps and was placed by the same method to be used for the backfill. Porosity samples from these would give very representative results if taken in the field. Recompact samples in the lab is less accurate than taking samples in situ. Simple sand cone (or balloon displacement) tests backed up by Proctor curves is a fast, inexpensive and relatively accurate way to determine the porosity.

5. The Dames and Moore study does not mention groundwater flow from the Rio Paguete into the mine area (however, it seems to be implied on page 15 of their report).

Momeni, et al. (p. 2-21) states that there is water loss in the mine area from the Rio Paguete. On December 3-4, 1980, the recharge was measured at approximately 22 gpm. The effect of this recharge should be accounted for in the model.

6. Dames' and Moore's model appears to allow for little recharge of the groundwater.

My mention of this item is little more than a reiteration of what already has been said. Various people have already questioned this aspect of the study. I feel some of the points I have brought up in this memo emphatically reinforce the view that a rerun of the model by the Water Resources Division of USGS, with new sampling of questionable data, is the most prudent course for building a reasonable model of the Jackpile-Paguete reclamation project.

Bibliography

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Wilson, Richard N., personal communication.

cc:

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